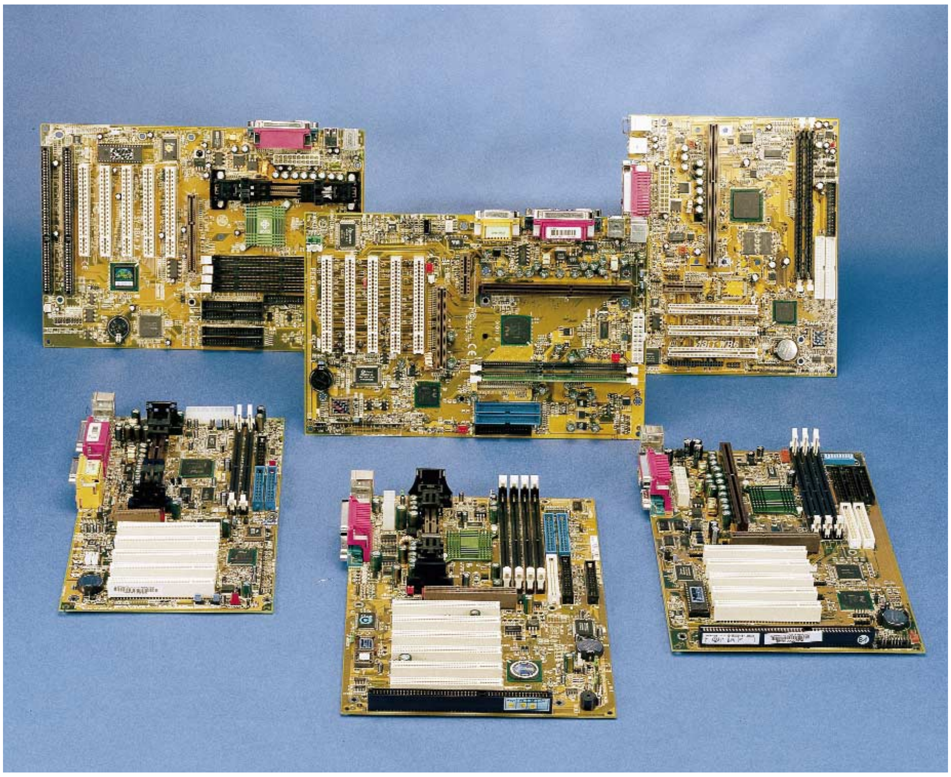
Slot 1 & Slot 2 – Socket 370 – Slot A – Socket 7

PC motherboards

a new generation

By Guy Raedersdorf

It's been nearly two and a half years since we published an article aimed at keeping you informed about the latest developments in the realms of PC motherboards. Given the incredible speed at which PC technology moves these days it seems appropriate to refresh our (and hopefully your) knowledge on the subject.



In the centre, the DFI PC64; next (clockwise), the Abit WB6, Abit BE6, MSI BX Master, DFI PW65E and finally Soyo's SY-6BA-IV.

A motherboard is by definition the foundation on which a PC is built. It combines essential elements like the CPU, chip set, memory, the input/output system and the extension bus (which is usually implemented as a number of connectors).

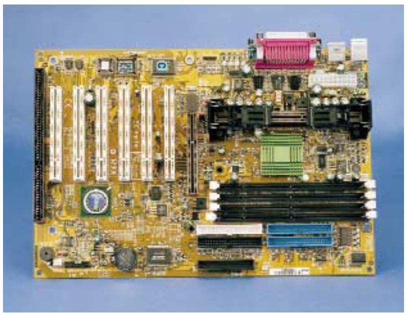
Looking at the virtual explosion of varieties and subvarieties of each of these elements, it is fair to say that the number of combinations is staggering.

Choosing one's own PC motherboard is a bit of a conundrum these days with dozens of manufacturers in the arena, each promoting their own product based on one of many available chip sets, the choice again depending on the CPU type to sit on the motherboard as well as on the features to be offered by the finished product.

Unfortunately, because of the large number of PC motherboard manufacturers it is not possible to give them all a mention in this article. The largest manufacturers are (in alphabetical order): Abit, Aopen, Asus, Biostar, Chaintech, DFI, EliteGroup, Epox, FIC, Gigabyte, Lucky Star, Micro Star International (MSI), NMC, Siemens, Soyo, SuperMicro, TMC and Tyan. There are many more!

This month we will be looking at PC motherboards featuring the **Slot 1** connector (developed for the Pentium II®/III® CPUs; note that some CPU detection software does not distinguish between a Pentium II® and a Pentium III®) and the **Slot 2** connector (developed for the Pentium II/III® Xeon). Note that Soyo's SY-D61GA motherboard is marked by a double slot 2.

One of the first things to remark if we scrutinise the technology applied to the motherboard we came examined for this article is that the majority of manufacturers stick to a BIOS supplied by Award. However, even if a number of manufac-



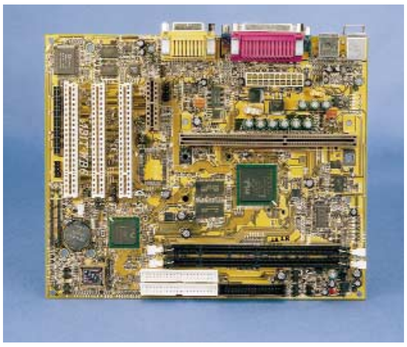
Colour coding to PC99 standard

PS/2 mouse	green
PS/2 keyboard	purple
Parallel port	burgundy
Serial ports	teal or turquoise
Game port	gold
Line Out	lime
Line In	light blue
Mic In	pink
(USB	black)

turers like Gigabyte and Soyo are 100% faithful to their BIOS source, others, including Supermicro and TMC, seem to 'flirt' with other BIOS suppliers like DMI and AMI.

BIOS memory devices like those supplied by Award increasingly feature a write-inhibit function for protection against viruses.

The second fact to note is that it appears to be extremely difficult for a manufacturer to produce a motherboard that is not obsolete the day it is rolled out. The speed of CPUs seems hard to keep up with! For example, as we write this an 800-MHz version of the Pentium III (Athlon®) was announced, so don't be surprised to read about 1-GHz CPUs by the



CPU sockets

Currently, five socket models are known:

1) Slot 1 for the Pentium II® and Pentium III® from Intel as well as for the Celeron®, provided they are mounted on an adapter.
2) Slot 2, it closely resembles Slot 1, but accepts the Pentium II® Xeon only.
3) Slot A designed for AMD's Athlon® CPU.
4) Socket 370 for the Celeron® PPGA from Intel.
5) Socket 7 which accepts a galaxy of CPUs ranging from the K2-6 through the KIII, not forgetting the WinChip and other Cyrix 686's.

Note that there are motherboards with two CPU sockets, for example, Abit's ABP6 which actually accommodates two Celeron® CPUs!

Chip sets

There exists a large number of chip sets from different manufacturers, the best known of which are probably Intel and VIA. Intel currently supplies the types 810 (Slot 1), 810e (Slot 1), 440BX (Slot 1), 440LX, 440ZX (Socket 370), 440GX and 820 (Slot 1). Currently, despite this wide variety, the real battle is between Intel's 440BX, 810(e) and 820 on the one hand, and VIA's competing product called Apollo Pro Plus.
Let's look at some of the more recent chip sets.

810e

This chip set consists of:
- FW82801 (FW = FirmWare), also known as the ICH chip set (I/O Controller Hub). This large-scale integration component (LSI) supports the following functions and is marked by these characteristics:
- complies with PCI Rev 2.2 for functionality up to 33 MHz;
- capable of handling six PCI connectors;
- integrates an IDE controller with Ultra DMA/66 capacity;
- features an USB host interface-for driving two USB ports;
- complies with the AC'97 2.1 standard for audio and telephony coders/decoders (CODECs)
- 82810e GMCH (Graphics Memory Controller Hub). The 82810 also goes by the name of Whitney® (although we must say that the difference in appearance with Ms Houston is striking).
- 82802 Firmware Hub (FWH)
  The FWH is a component found in different chip sets from Intel. The hardware characteristics of this component comprise an RNG (Random Number Generator), five GPIs (General Purpose Input), and block latching by register or hardware.

820

After major problems which reportedly have been solved as we write this, the 820 chip set from Intel (a.k.a. Camino®) seems to make good progress, and consequently an increasing number of motherboard manufacturers, including MSI and DFI, are starting to adopt it. The thing about this new chip set is that it supports the new generation of DRAM memory circuits dubbed 'Rambus'.

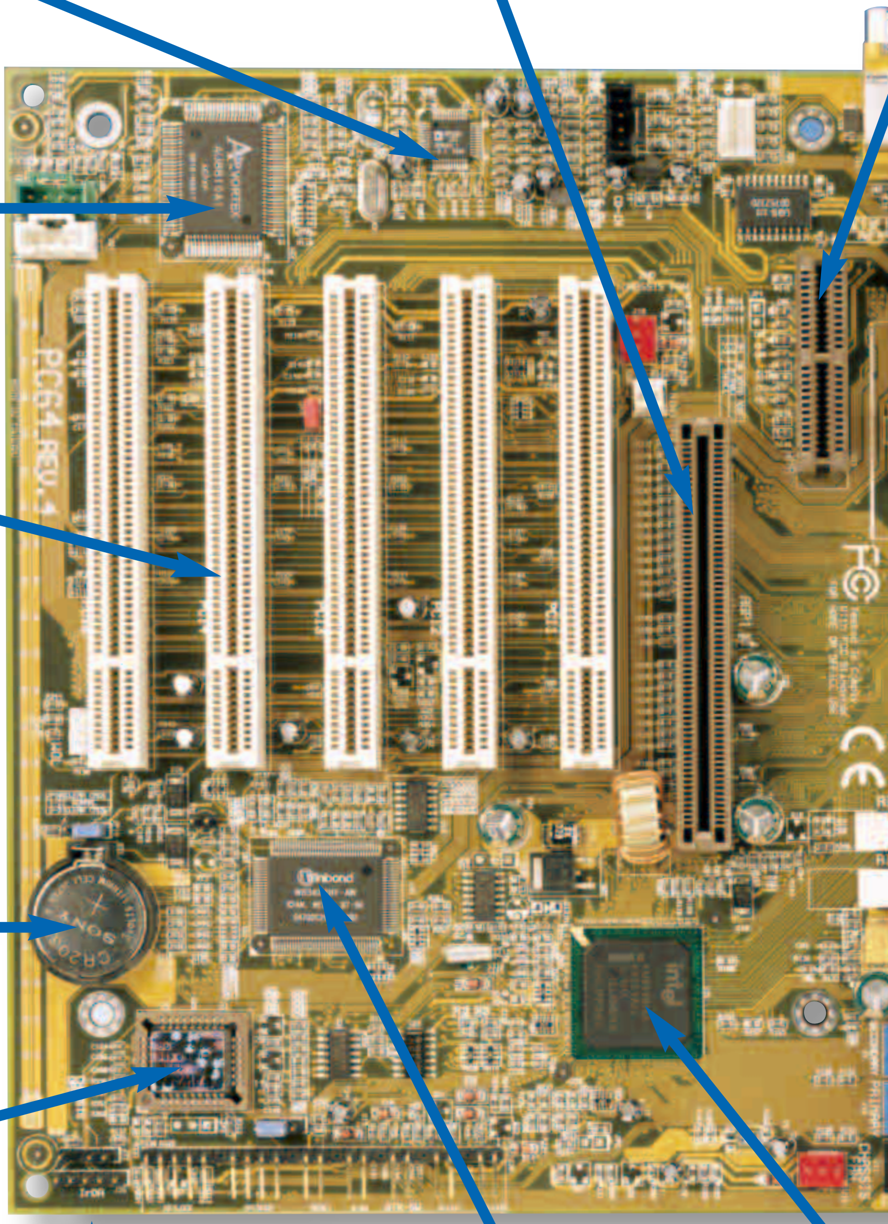
Destined for use in PCs employing the fastest versions of the Pentium III®, the 820 supports a 4x AGP port, a 1.6-Gbyte/s graphics interface and a data transfer speed of 266 MB/s on the system bus. This chip set comprises a memory controller, an I/O controller and a firmware section consisting of a BIOS stored in Flash memory.

The 820 is important because it enables the new generation of DRDRAM (Direct Rambus Dynamic RAM) components to be employed. In general, the majority of manufacturers provide only two DRDRAM connectors on their motherboards.

What's on a motherboard?

AGP Connector
(Accelerated Graphic Port). This connector receives the video card which is given direct access to the 66-MHz system bus, instead of via the slower (33-MHz) PCI route. Sideband Addressing technology combined with a 2? multiplier allows AGP video cards to communicate with the CPU at a speed of 133 MHz. Today there are also 4-speed AGP connectors with a potential throughput of 1,056 Mbytes/s.

AC97 Audio Controller



Audio Controller
On this board an Aurela AU8810 is found. An increasing number of motherboards have on-board (integrated) audio and video functions (not on the PC64).

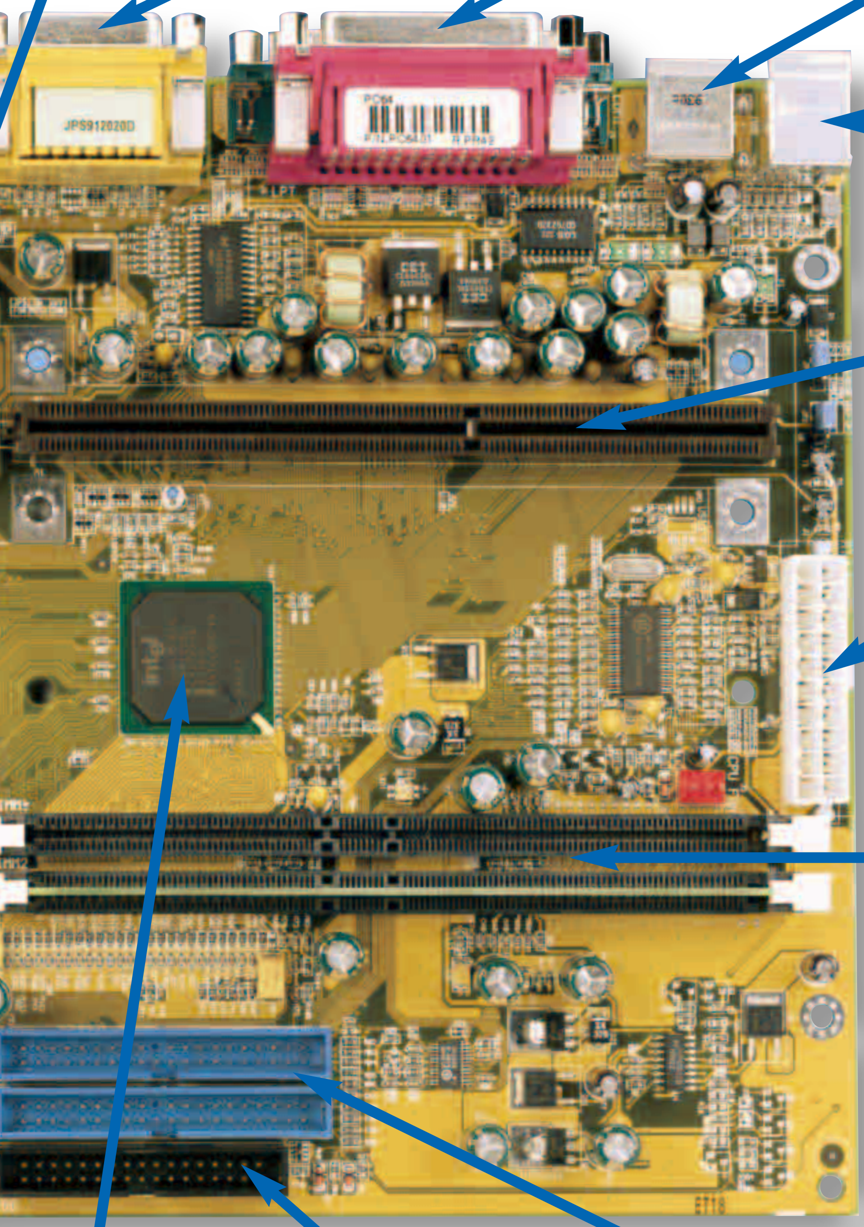
Extension Connectors
These take the form of five PCI slots. Note that ISA slots are not available.

Lithium Backup Battery
This component serves to retain user settings for the system (CMOS Data). Note the presence of a jumper that allows you to return to default data stored in the BIOS ROM (very useful when you can't remember your password).

BIOS
The BIOS acts as a interface between the user system and the electronics on the motherboard. The electronics in turn control various peripheral devices installed in, or connected to, a PC. Nearly all of today's BIOSes are Flash devices, hence the expression 'BIOS re-flashing' for updating the contents of this memory device.
Note that there are motherboards with dual BIOS support (for example, the Abit BP6).

IrDA Connector
By means of this connector, it is possible to establish a wireless (infrared) link between the PC and suitable peripheral devices.

Input/Output (I/O) Hardware



AMR Connector
The AMR (Audio Modem Riser) connector represents an open industry standard which defines an expandable hardware interface supporting audio as well as modem functions.

Game Port Connector and Audio Input/Output Connectors

Parallel Port and COM1-COM2 Connectors

Two USB Ports

PS/2 Mouse and Keyboard Sockets

Slot 1
for the CPU, Pentium II® and Pentium III® in this case, or a Celeron® using an adaptor (see inset on CPU sockets).

ATX Power Connector
A few oddball motherboards have a double supply connector: one 20-pin ATX-style, and one 12-pin Baby-AT style which is even older. Here's proof that the metal case and the power supply are often the only 'components' in a PC to reach a mature age.

Memory connectors
Because of the 820 chip set, the connectors on this motherboard are intended for 184-pin (expensive) SRIMM modules.
However the vast majority of cards currently on the market have connectors for (industry-standard) 168-pin DIMMs. Note that there are motherboards, like SuperMicro's PIIISCA, that allow DIMM (SDRAM) as well as RIMM (RDRAM) to be fitted. 72-pin memory module connectors have virtually disappeared from the scene. A pity because all those 4-Mbyte and 8-Mbyte will go to waste.
Note the absence of a cache module on the board. The CPU now has its own cache, so separate chips are no longer required.

Chip set,
here the 820 is applied, comprising two or three chips.

Floppy Disk Drive Connector (FDD)

Hard Disk, CD-ROM/DVD, IDE1 (primary) and IDE2 (secondary) Connectors

Memory

Once again, new memory devices have appeared on the market, so let's have a look at them.

168-pin DIMM

With the proliferation of no-name 168-pin sockets DIMMs acting as SDRAM in the PC, it has become relatively easy to upgrade your PC with more memory. Since the memory structure is now invariably based on a width of 16 bits, it is no longer necessary to install memory modules in pairs. Today, it is possible to go from 32 Mbytes to 96 Mbytes by the simple addition of one 64-Mbyte DIMM. Meanwhile, you are of course well advised to wait for memory prices to (again) drop to an acceptable level.

RAMbus RIMM

The arrival of the 820 chip set was 'in tune' with the appearance of a new memory device, the RAMbus RIMM.

The maximum available memory depends on the size of each device (chip) used; in fact, it equals 32 times the memory capacity offered by a single chip. Why 32 times? Well, this takes into account that the maximum number of chips supported by a single RAMbus channel is 32, and that the system has just one of these channels. By the way, at 1.6 GB/s, the 'throughput' of a DRDRAM chip is considerably higher than that offered by a traditional DRAM.

At this point, we will have to return to school for some basic arithmetic, or learn to use a calculator. It is sufficient to convert the capacity of the chips in Megabytes to know the total available memory size. Chips with a capacity of 64 Mbits (8 Mbytes) give us a maximum size of 8?32=256 Mbytes. Using 128 Mbit chips this value will double, while 256 Mbit chips offer the highest achievable amount of addressable memory, i.e., 1 GBytes (32?32). But that's not all! The RIMM-style RAM having the largest number of chips must be installed in position 'RIMM1' (rule 1); while the maximum number of chips is 32 (rule 2). If one of the connectors remains empty is has to be fitted with a 'continuity' module (as seen, for instance, on the DFI PC64 motherboard).

VCM-SDRAM memory

Currently, Apollo from VIA is the only chip set to support VCM-SDRAM memory (VCM = Virtual Channel Memory). This modern get-together seems to be marginally faster than other 'couples', like the BX chipset linked to traditional DIMM. VCM-SDRAM modules can be installed in DIMM sockets without any kind of adaptation.

Now who was that again claiming that things would only get simpler?

time this magazine is out (April 2000).

As you will no doubt be able to figure out from the introductory photograph, the following PC motherboard manufacturers (and their distributors) kindly put one or more products to our disposal:
DFI: models PC64 and PW65-E
Abit: models WB6 and BE6
MSI: model BX master
Soyo: model SY-6BA + IV

The co-operation of these suppliers in writing and illustrating this article is gratefully acknowledged.

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Internet addresses

If you want to know more about the motherboards mentioned in this instalment, have a look at the following websites.

DFI : www.dfi.com.tw
Abit : www.abit.com.tw
MSI : www.msi.com.tw
Soyo : www.soyo.nl
Biostar : biostar.com.tw
FIC : fic.com.tw
AOpen : www.aopen.com.tw
Tyan : www.tyan.com
ChainTech :www.chaintech.com.tw
Gigabyte : giga-byte.com.tw

Other interesting links :

Overclocking :
http://hardwarezone.phing.com/
Tom's Hardware :
www.tomshardware.com

Footprints

'ATX' is currently the most popular footprint (or form factor) for a PC motherboard.

Even if called a standard, its dimensions seem to be open to negotiation, ranging from 205mm × 190mm to 305mm × 210mm, while 330mm × 310mm is also encountered.

The older AT footprint has a size of 220mm × 240mm.

Special functions

Suspend to RAM

This function allows the system to be powered down either by pressing the main on/off switch or by selecting the 'Standby' function after closing Windows®98 but without having to close all files, windows and applications to finally be able to close the operating system itself. In this way, you enable the system to store all open program files and data in RAM just before switching off. Once the supply power is restored, the system will be in the same state as before it was switched off.

WOL (Wake-On-Lan)

This connector is used to provide a link to a LAN (Local Area Network) card having a mating socket. In a network, this function allows the system to go into Soft Power Down Mode (Soft-Off). If the system is in Suspend mode, an IRQ or a DMA action is required to put it on the road again.

WOR (Wake-On-Ring)

This connector is usually linked to an internal modem. It allows a system in Suspend or Soft Power Off mode to 'wake up' or start working again (power-on) after detecting an external trigger signal applied to it by a modem.

Chassis Open

When this function is activated in the BIOS, and provided the corresponding detection device actually exists, the system flags an 'open chassis' condition.

RIMM LED

This LED usually lights up red when the system is powered, or when the system is in Suspend mode (Power On Suspend or Suspend to RAM). The same LED goes green (and not with envy) when the system goes into Soft-Off mode.

The same goes for the PCI Standby Power LED which goes red when the PC is in Soft-Off or Suspend mode (Power On Suspend or Suspend to RAM)